CHAPTER 45-12-05
POWER BOILERS - EXISTING INSTALLATIONS

45-12-05-01. Maximum allowable working pressure for standard boilers. The maximum allowable working pressure for standard boilers must be determined in accordance with the applicable provisions of the edition of the American Society of Mechanical Engineers Code under which they were constructed and stamped.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-02. Maximum allowable working pressure for nonstandard boilers.

1. The maximum allowable working pressure on the shell of a nonstandard boiler must be determined by the strength of the weakest section of the structure, computed from the thickness of the plate, the tensile strength of the plate, the efficiency of the longitudinal joint or tube ligaments, the inside diameter of the weakest course and the factor of safety allowed by this article.

$\frac{TStE}{RFS}$ = Maximum allowable working pressure, per square inch gauge where:

TS = Ultimate tensile strength of shell plates per square inch

t = Minimum thickness of shell plate, in weakest course, inches

E = Efficiency of longitudinal joint:

For tube ligaments and riveted construction, E shall be determined by the rules given in section I, part PR, of the American Society of Mechanical Engineers Code for power boilers. For seamless construction, E shall be considered one hundred percent.

R = Inside radius of the weakest course of the shell, in inches

FS = Factor of safety permitted

2. When the tensile strength of steel or wrought iron shell plate is not known, it must be taken as fifty-five thousand pounds per square inch [386.11 megapascals] for steel and forty-five thousand pounds per square inch [310.26 megapascals] for wrought iron.

3. The resistance to crushing of mild steel must be taken at ninety-five thousand pounds per square inch [655 megapascals] of the cross-sectional area.

4. When computing the ultimate strength of rivets in shear, the following values, in pounds per square inch [megapascals] of the cross-sectional area of the rivet shank must be used:

	POUNDS PER SQUARE INCH	MEGAPASCALS
Iron rivets in single shear	38,000	262.00
Iron rivets in double shear	76,000	524.00
Steel rivets in single shear	44,000	303.37
Steel rivets in double shear	88,000	606.69

When the diameter of the rivet holes in the longitudinal joints of a boiler is not known, the diameter and cross-sectional area of rivets, after driving, may be selected from the following table, or as ascertained by cutting out one rivet in the body of the joint.

SIZES OF RIVETS BASED ON PLATE THICKNESS

Thickness of plate, inches	1/4	9/32	5/16	11/32	3/8	13/32
Diameter of rivet after driving, inches	11/16	11/16	3/4	3/4	13/16	13/16

Thickness of plate, inches	7/16	15/32	1/2	9/16	5/8
Diameter of rivet after driving, inches	15/16	15/16	15/16	1-1/16	1-1/16

5. The following factors of safety must be increased by the inspector if the condition and safety of the boiler demand it:

   The lowest factor of safety permissible on existing installations is four and five-tenths, except for horizontal-return-tubular boilers having continuous longitudinal lap seams more than twelve feet [3.66 meters] in length, when the factor of safety is eight; when this latter type boiler is removed from its existing setting, it may not be reinstalled for pressures in excess of fifteen pounds per square inch gauge [103 kilopascals].

   Reinstalled or secondhand boilers must have a minimum factor of safety of six when the longitudinal seams are of lap-riveted construction, and a minimum factor of safety of five when the longitudinal seams are of butt-and-double-strap construction. Seam traction engines must be considered as secondhand boilers for purposes of determining their factors of safety.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-03. Age limit of existing boilers.

1. The age limit of any boiler of nonstandard construction is thirty years except that after a thorough internal and external inspection and a hydrostatic pressure test of one and one-half times the allowable working pressure held for a period of at least thirty minutes during which no distress or leakage develops, any boiler having other than a lap-riveted longitudinal joint may be continued in operation without reduction in working pressure. The age limit of any boiler having lap-riveted longitudinal joints and operating at a pressure in excess of fifty pounds per square inch [344.74 kilopascals] is twenty years; this type of boiler, when removed from an existing setting, may not be reinstalled for a pressure in excess of fifteen pounds per square inch [103 kilopascals]. A reasonable time for replacement, not to exceed one year, may be given at the discretion of the chief boiler inspector.

2. The shell or drum of a boiler in which a typical lap seam crack is discovered along a longitudinal riveted joint for either butt seam or lap joints must be permanently discontinued for use under steam pressure. "Lap seam crack" means the typical crack frequently found in lap

seams extending parallel to the longitudinal joint and located either between or adjacent to rivet holes.

3. The age limit of boilers of standard construction installed prior to the date this law becomes effective is dependent on thorough internal and external inspection and hydrostatic pressure test of one and one-half times the allowable working pressure for a period of thirty minutes. If the boiler under these test conditions exhibits no distress or leakage, it may be continued in operation at the same working pressure.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-04. Welded boilers. Boilers that have either longitudinal or circumferential seams of fusion welded construction must have been constructed and stamped in accordance with the rules and regulations of the American Society of Mechanical Engineers Code or must have the standard stamping of another state that has adopted a standard of construction equivalent to the standards of the American Society of Mechanical Engineers Code.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-05. Pressure on old boilers. The maximum working pressure of an old boiler may not be increased to a greater pressure than would be allowed for a new boiler of the same construction.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-06. Cast iron headers and mud drums. The maximum allowable working pressure on a watertube boiler, the tubes of which are secured to a cast iron or malleable iron header, or which have cast iron mud drums, may not exceed one hundred sixty pounds per square inch gauge [1103.17 kilopascals].

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-07. Pressure on cast iron boilers. The maximum allowable working pressure for any cast iron boiler, except hot water boilers, is fifteen pounds per square inch gauge [103 kilopascals].

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-08. Safety valves and safety relief valves.

1. Each boiler must have at least one American society of mechanical engineers approved safety valve and if it has more than five hundred square feet [46.45 square meters] of water heating surface, or if an electric boiler it has a power input of more than eleven hundred kilowatts, it must have two or more American society of mechanical engineers approved safety valves.

2. The safety valve capacity for each boiler must be such that the safety valve, or valves will discharge all the steam that can be generated by the boiler without allowing the pressure to rise more than six percent above the highest pressure at which any valve is set and in no case to more than six percent above the maximum allowable working pressure. The safety valve capacity of new units may not be less than the maximum designed steaming capacity as determined by the manufacturer.

3. The required steam relieving capacity in pounds per hour, of the safety relief valves on a high temperature water boiler must be determined by dividing the maximum output in British thermal units at the boiler nozzle obtained by the firing of any fuel for which the unit is designed by one thousand (one British thermal unit equals 1.055 x 10 to the 3rd power joules).

4. One or more safety valves on the boiler proper must be set at or below the maximum allowable working pressure. If additional valves are used, the highest pressure setting may not exceed the maximum allowable working pressure by more than three percent. The complete range of pressure settings of all the saturated steam safety valves on a boiler may not exceed ten percent of the highest pressure to which any valve is set. Pressure setting of safety relief valves on high temperature water boilers may exceed this ten percent range.

5. For a forced-flow steam generator with no fixed steamline and waterline, equipped with automatic controls and protective interlocks responsive to steam pressure, safety valves may be installed in accordance with the following, as an alternative:

    a. One or more power-actuated pressure-relieving valves must be provided in direct communication with the boiler when the boiler is under pressure and must receive a control impulse to open when the maximum allowable working pressure at the superheater outlet is exceeded. The total combined relieving capacity of the power-actuated pressure-relieving valves may be not less than ten percent of the maximum design steaming capacity of the boiler under any operating condition as determined by the manufacturer. The valves must be located in the pressure part system where they will relieve the overpressure.

An isolating stop valve of the outside-screw-and-yoke type may be installed between the power-actuated pressure-relieving valve and the boiler to permit repairs provided an alternate power-actuated pressure-relieving valve of the same capacity is so installed as to be in direct communication with the boiler.

b. Spring-loaded safety valves must be provided having a total combined relieving capacity, including that of the power-actuated pressure-relieving valve installed under subdivision a of subsection 5, of not less than one hundred percent of the maximum designed steaming capacity of the boiler, as determined by the manufacturer. In this total credit in excess of thirty percent of the total relieving capacity may not be allowed for the power-actuated pressure-relieving valves actually installed. Any or all of the spring-loaded safety valves may be set above the maximum allowable working pressure of the parts to which they are connected but the set pressures must be such that when all these valves (together with the power-actuated pressure-relieving valves) are in operation the pressure will not rise more than twenty percent above the maximum allowable working pressure of any part of the boiler, except for the steampiping between the boiler and the prime mover.

c. When stop valves are installed in the water-steam flow path between any two sections of a forced-flow steam generator with no fixed steamline and waterline:

(1) The power-actuated pressure-relieving valve required by subdivision a of subsection 5 must also receive a control impulse to open when the maximum allowable working pressure of the component, having the lowest pressure level upstream to the stop valve, is exceeded.

(2) The spring-loaded safety valve must be located to provide the pressure protection requirements of subdivision b or c of subsection 5.

(3) A reliable pressure-recording device must always be in service and records kept to provide evidence of conformity to the above requirements.

6. All safety valves or safety relief valves must be so constructed that the failure of any part cannot obstruct the free and full discharge of steam and water from the valve. Safety valves must be of the direct spring-loaded pop type, with seat inclined at any angle between forty-five and ninety degrees, inclusive, to the centerline of the spindle. The coefficient of discharge of safety valves must be determined by actual steam-flow measurements at a pressure not more than three percent above the pressure at which the valve is set to blow.

7. Safety valves or safety relief valves may be used which give any opening up to the full discharge capacity of the area of the opening of the inlet of the valve, provided the movement of the valve is such as not to induce lifting of water in the boiler.

8. Deadweight or weighted-lever safety valves or safety relief valves may not be used.

9. For high temperature water boilers safety relief valves must be used. Such valves must have a closed bonnet. For purposes of selection, the capacity rating of such safety relief valves must be expressed in terms of actual steam flow determined on the same basis as for safety valves. In addition, the safety relief valves must be capable of satisfactory operation when relieving water at the saturation temperature corresponding to the pressure at which the valve is set to blow.

10. A safety valve or safety relief valve over three inches [76.20 millimeters] in size, used for pressure greater than fifteen pounds per square inch gauge [103 kilopascals], must have a flange inlet connection or a welding-end inlet connection. The dimensions of flanges subjected to boiler pressure must conform to the applicable American national standards.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-09. Superheater safety valve requirements.

1. Every attached superheater must have one or more safety valves near the outlet. If the superheater outlet header has a full, free, steam passage from end to end and is so constructed that steam is supplied to it at practically equal intervals throughout its length so that there is a uniform flow of steam through the superheater tubes and the header, the safety valve or valves may be located anywhere in the length of the header.

2. The discharge capacity of the safety valve or valves on an attached superheater may be included in determining the number and size of the safety valves for the boiler provided there are no intervening valves between the superheater safety valve and the boiler, and provided the discharge capacity of the safety valve or valves, on the boiler, as distinct from the superheater, is at least seventy-five percent of the aggregate valve capacity required.

3. Every independently fired superheater that may be shut off from the boiler and permit the superheater to become a fired pressure vessel must have one or more safety valves having a discharge capacity equal

to six pounds of steam per square foot [2.72 kilograms per square meter] of superheater surface measured on the side exposed to the hot gases. The number of safety valves installed must be such that the total capacity is at least equal to that required.

4. Every reheater must have one or more safety valves, such that the total relieving capacity is at least equal to the maximum steam flow for which the reheater is designed. At least one valve must be located on the reheater outlet. The relieving capacity of the valve on the reheater outlet may not be less than fifteen percent of the required total. The capacity of reheater safety valves may not be included in the required relieving capacity for the boiler and superheater.

5. A soot-blower connection may be attached to the same outlet from the superheater or reheater that is used for the safety valve connection.

6. Every safety valve used on a superheater or reheater discharging superheated steam at a temperature over four hundred fifty degrees Fahrenheit [232.2 degrees Celsius], must have a casing, including the base, body, bonnet, and spindle. Construction must be of steel, steel alloy, or equivalent heat-resistant material.

   The valve must have a flanged inlet connection or a welding-end inlet connection. It must have the seat and disk of suitable heat-erosive and corrosive-resistant material, and the spring fully exposed outside of the valve casing so that it is protected from contact with the escaping steam.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-10. Capacity.

1. The minimum safety valve or safety relief valve relieving capacity for other than electric boilers, and forced-flow steam generators with no fixed steamline and waterline, must be determined on the basis of the pounds of steam generated per hour per square foot of boiler heating surface and waterwall heating surface, as given in the following table:

MINIMUM POUNDS OF STEAM PER HOUR PER SQUARE FOOT OF SURFACE

	Firetube Boilers	Watertube Boilers
Boiler heating surface		
Hand-fired	5	6

Stoker-fired	7	8
Oil-, gas-, or pulverized-fuel-fired	8	10
Waterwall heating surface		
Hand-fired	8	8
Stoker-fired	8	8
Oil-, gas-, or pulverized-fuel-fired	14	16

When a boiler is fired only by a gas having a heat value not in excess of two hundred British thermal units [745.58 x 10 to the 4th power joules] per cubic foot [cubic meter], the minimum safety valve or safety relief valve relieving capacity may be based on the values given for hand-fired boilers above.

The minimum safety valve or safety relief valve relieving capacity for electric boilers is three and one-half pounds [3692.5 joules] per hour per kilowatt input.

In any cases a greater relieving capacity of safety valves or safety relief valves will have to be provided than the minimum specified by this rule, and in every case the requirements of section 45-12-05-08 must be met.

2. The heating surface must be computed for that side of the boiler surface exposed to the products of combustion, exclusive of the superheating surface. In computing the heating surface for this purpose, only the tubes, fireboxes, shells, tube sheets, and the projected area of headers need be considered, except that for vertical firetube steam boilers, only that portion of the tube surface up to the middle gauge cock is to be computed. The minimum number and size of safety valves or safety relief valves required must be determined on the basis of the aggregate relieving capacity and the relieving capacity marked on the valves by the manufacturer. If the operating conditions are changed, or additional heating surface such as water screens or waterwalls is connected to the boiler circulation, the safety valve or safety relief valve capacity must be increased, if necessary, to meet the new conditions and be in accordance with subsection 2 of section 45-12-05-08. The additional valves required on account of changed conditions may be installed on the steamline or waterline between the boiler and the main stop valve except when the boiler is equipped with a superheater or other apparatus, in which case they may be installed on the steam pipes between the boiler drum and the inlet to the superheater or other apparatus, provided that the steam main between the boiler and points where a safety valve or valves may be attached has a cross-sectional area at least three times the combined areas of the inlet connections to the safety valves applied to it.

3. If the safety valve or safety relief valve capacity cannot be computed or if it is desirable to prove the computations, it may be checked in any one

of the three following ways, and if found insufficient, additional capacity must be provided:

a. By making an accumulation test, that is, by shutting off all other steam-discharge outlets from the boiler and forcing the fires to the maximum. The safety valve equipment must be sufficient to prevent an excess pressure beyond that specified in subsection 2 of section 45-12-05-08. This method should not be used on a boiler with a superheater or reheater or on a high temperature water boiler.

b. By measuring the maximum amount of fuel that can be burned and computing the corresponding evaporative capacity upon the basis of the heating value of the fuel.

c. By determining the maximum evaporative capacity by measuring the feedwater. The sum of the safety valve capacities marked on the valves must be equal to or greater than the maximum evaporative capacity of the boiler. This method may not be used on high temperature water boilers.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-11. Mounting.

1. When two or more safety valves are used on a boiler, they may be mounted either separately or as twin valves made by placing individual valves on Y-bases, or duplex valves having two valves in the same body casing. Twin valves made by placing individual valves on Y-bases or duplex valves having two valves in the same body must be of equal size.

   When not more than two valves of different sizes are mounted singly the relieving capacity of the smaller valve may not be less than fifty percent of that of the larger valve.

2. The safety valve or safety relief valve or valves must be connected to the boiler independent of any other connection, and attached as close as possible to the boiler without any unnecessary intervening pipe or fitting. Such intervening pipe or fitting may not be longer than the face-to-face dimension of the corresponding tee fitting of the same diameter and pressure under the applicable American national standard rating. Every safety valve or safety relief valve must be connected so as to stand in an upright position with spindle vertical.

3. The opening or connection between the boiler and the safety valve or safety relief valve must have at least the area of the valve inlet. No valve

of any description may be placed between the required safety valve or valves and the boiler nor on the discharge pipe between the safety valve or safety relief valve and the atmosphere. When a discharge pipe is used, the cross-sectional area may not be less than the full area of the valve outlet or of the total of the areas of the valve outlets, discharging thereinto and must be as short and straight as possible and arranged to avoid undue stresses on the valve or valves.

All safety valve or safety relief valve discharges must be so located or piped as to be carried clear from running boards or platforms. Ample provision for gravity drain must be made in the discharge pipe at or near each safety valve or safety relief valve, and where water or condensation may collect. Each valve must have an open gravity drain through the casing below the level of the valve seat. For iron-and-steel-bodied valves exceeding two inches [50.8 millimeters] in size, the drain hole must be tapped not less than three-eighths-inch [9.53-millimeter] pipe size.

Discharge piping from safety relief valves on high temperature water boilers must have adequate provisions for water drainage as well as for steam venting.

The installation of cast iron-bodied safety relief valves for high temperature water boilers is prohibited.

4. If a muffler is used on a safety valve or safety relief valve, it must have sufficient outlet area to prevent back pressure from interfering with the proper operation and discharge capacity of the valve. The muffler plates or other devices must be so constructed as to avoid a possibility of restriction of the steam passages due to deposits. Mufflers may not be used on high temperature water boiler safety relief valves.

   When a safety valve or safety relief valve is exposed to outdoor elements which may affect operation of the valve, it is permissible to shield the valve with a satisfactory cover. The shield or cover must be property vented and arranged to permit servicing and normal operation of the valve.

5. When a boiler is fitted with two or more safety valves or safety relief valves on one connection, this connection to the boiler must have a cross-sectional area not less than the combined areas of inlet connections of all the safety valves or safety relief valves with which it connects.

6. Safety valves may be attached to drums or headers by welding, provided the welding is done in accordance with the requirements of this article.

7. Every boiler must have proper outlet connections for the required safety valve, or safety relief valve, or valves, independent of any other outside steam connection, the area of opening to be at least equal to the aggregate areas of inlet connections of all of the attached safety valves or safety relief valves. An internal collecting pipe, splash plate, or pan may be used, provided the total area for inlet of steam thereto is not less than twice the aggregate areas of the inlet connections of the attached safety valves. The holes in such collecting pipe must be at least one-fourth inch [6.35 millimeters] in diameter and the least dimension in any other form of opening for inlet of steam must be one-fourth inch [6.35 millimeters].

   Such dimensional limitations to operation for steam need not apply to steam scrubbers or driers provided the net free steam inlet area of the scrubber or drier is at least ten times the total area of the boiler outlets for the safety valves.

8. If safety valves are attached to a separate steam drum or dome, the opening between the boiler proper and the steam drum or dome must be not less than required by above.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-12. Operation.

1. Safety valves must be designed and constructed to operate without chattering and to attain full lift at a pressure no greater than three percent above their set pressure. After blowing down, all valves must close at a pressure not lower than ninety-six percent of the set pressure of the lowest set valve. The minimum blowdown in any case is two pounds per square inch [13.79 kilopascals]. For spring-loaded pop safety valves for pressures between one hundred pounds per square inch [689.48 kilopascals] and three hundred pounds per square inch [2068.44 kilopascals], both inclusive, the blowdown is not less than two percent of the set pressure. To ensure the guaranteed capacity and satisfactory operation, the blowdown as marked upon the valve may not be reduced.

   Safety valves used on forced-flow steam generators with no fixed steamline and waterline, and safety relief valves, used on high temperature water boilers, may be set and adjusted to close after blowing down not more than ten percent of the set pressure. The valves for these special uses must be so adjusted and marked by the manufacturer.

2. The blowdown adjustment must be made and sealed by the manufacturer or approved testing facility.

3. The popping-point tolerance plus or minus may not exceed the following: two pounds per square inch [13.79 kilopascals] for pressures up to and including seventy pounds per square inch [482.63 kilopascals], three percent for pressures from seventy-one pounds per square inch [483.0 kilopascals] to three hundred pounds per square inch [2068.44 kilopascals], ten pounds per square inch [68.95 kilopascals] for pressures from three hundred one pounds per square inch [2069.0 kilopascals] to one thousand pounds per square inch [6894.80 kilopascals], and one percent for pressures over one thousand pounds per square inch [6894.80 kilopascals].

4. To ensure the valve being free, each safety valve or safety relief valve must have a substantial lifting device by which the valve disk may be positively lifted from its seat when there is at least seventy-five percent of full working pressure on the boiler. The lifting device must be such that it cannot lock or hold the valve disk in lifted position when the exterior lifting force is released.

   Safety relief valve disks used on high temperature water boilers may not be lifted while the temperature of the water exceeds two hundred degrees Fahrenheit [93.3 Celsius]. If it is desired to lift the valve disk to assure that it is free, this shall be done when there is at least seventy-five percent of full working pressure on the boiler. For high temperature water boilers, the lifting mechanism must be sealed against leakage.

5. The seats and disks of safety valves or safety relief valves must be of suitable material to resist corrosion. The seat of a safety valve must be fastened to the body of the valve so that there is no possibility of the seat lifting.

6. Springs used in safety valves may not show a permanent set exceeding one percent of their free length ten minutes after being released from a cold compression test closing the spring solid.

7. The spring in a safety valve or safety relief valve in service for pressures up to and including two hundred fifty pounds per square inch [1683.7 kilopascals] may not be used for any pressure more than ten percent above or ten percent below that for which the safety valve or safety relief valve is marked. For higher pressures the spring may not be reset for any pressure more than five percent above or five percent below that for which the safety valve or safety relief valve is marked.

8. If the operating conditions of a valve are changed so as to require a new spring under subsection 1 for a different pressure, the valve must

be adjusted by the manufacturer or the manufacturer's authorized representative who shall furnish and install a new nameplate.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-13. Steam stop valves.

1. Each discharge outlet, except safety valve, safety relief valves, reheater inlet and outlet, or superheater inlet connections, must be fitted with a stop valve located at an accessible point in the steam-delivery line and as near the boiler nozzle as is convenient and practicable. When such outlets are over two-inch [50.8-millimeter] pipe size, the valve or valves used on the connection must be of the outside-screw-and-yoke-rising-spindle type so as to indicate from a distance by the position of its spindle whether it is closed or open, and the wheel may be carried either on the yoke or attached to the spindle. A plug-cock-type valve may be used provided the plug is held in place by a guard or a gland, the valve is equipped to indicate from a distance whether it is closed or open, and the valve is equipped with a slow-opening mechanism. In the case of a single boiler and prime mover installation, the stop valve required herein may be omitted provided the prime mover throttle valve is equipped with an indicator to show whether the valve is open or closed and is designed to withstand the required hydrostatic pressure test of the boiler.

2. When the boilers are connected to a common header, the connection from each boiler having a manhole opening must be fitted with two stop valves having an ample free-blow drain between them. The discharge of this drain must be visible to the operator while manipulating the valve. The stop valves must consist preferably of one automatic nonreturn valve (set next to the boiler) and a second valve of the outside-screw-and-yoke type must be used. Where intercommunicating systems of different pressures are installed, every boiler on each system must be equipped with an automatic nonreturn valve set next to the boiler.

3. When more than one stop valve is required, it shall have a pressure rating at least equal to that required for the expected steam temperature and pressure at the valve, or the pressure rating at least equal to eighty-five percent of the lowest set pressure of any safety valve on the boiler drum and for the expected temperature of the steam at the valve, whichever is greater.

4. All valves and fittings on steamlines shall have a pressure rating of at least one hundred pounds per square inch [689.48 kilopascals] in

accordance with the applicable American national standards institute standard.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-14. Feedwater valves and piping.

1. Except for high temperature water boilers, the feedpipe must be provided with a check valve near the boiler and a valve or cock between the check valve and the boiler. When two or more boilers are fed from a common source, there must also be a globe or regulating valve on the branch to each boiler located between the check valve and the source of supply. Whenever globe valves are used on feedpiping, the inlet must be under the disk of the valve. On single boiler-turbine unit installations, the boiler feed shutoff valve may be located upstream from the boiler feed check valve.

2. When the supply line to a boiler is divided into branch feed connections and all such connections are equipped with stop and check valves, the stop and check valves in the common source may be omitted.

3. If a boiler is equipped with duplicate feed arrangements, each such arrangement must be equipped as required by these rules.

4. A combination stop-and-check valve in which there is only one seat and disk and a valve stem is provided to close the valve when the stem is screwed down must be considered only as a stop valve, and a check valve must be installed as otherwise provided.

5. Where an economizer or other feedwater-heating device is connected directly to the boiler without intervening valves, the feed valves and check valves required must be placed on the inlet of the economizer or feedwater-heating device.

6. The recirculating return line for a high temperature water boiler must be provided with the same stop valve, or valves, required by subsection 1 of section 45-12-05-13 for the main boiler and the required stop valve or valves is optional. A check valve may not be a substitute for a stop valve.

7. Except as provided for in subsections 8 and 10, boilers having more than five hundred square feet [46.45 square meters] of water-heating surface must have at least two means of feeding water. Each source of feeding must be capable of supplying water to the boiler at a pressure of six percent higher than the highest setting of any safety valve on the boiler. For boilers that are fired with solid fuel not in suspension, and for boilers whose setting or heat source can continue to supply sufficient

heat to cause damage to the boiler if the feed supply is interrupted, one such means of feeding must not be subject to the same interruption as the first method.

8. Except as provided for in subsection 7, boilers fired by gaseous, liquid, or solid fuel in suspension may be equipped with a single means of feeding water provided means are furnished for the immediate shut off of heat input if the water feed is interrupted.

9. For boilers having a water-heating surface of not more than one hundred square feet [9.29 square meters], the feedpiping and connection to the boiler may not be smaller than one-half-inch [12.7-millimeter] pipe size. For boilers having a water-heating surface more than one hundred square feet [9.29 square meters], the feedpiping and connection to the boiler may not be less than three-quarter-inch [19.05-millimeter] pipe size.

10. High temperature water boilers must be provided with means of adding water to the boiler or system while under pressure.

11. The feedwater must be introduced into a boiler in such a manner that the water will not be discharged directly against surfaces exposed to gases of high temperature or to direct radiation from the fire or close to any riveted joints of the furnace sheets or of the shell. For pressures of four hundred pounds [2757.92 kilopascals] or over, the feedwater inlet through the drum must be fitted with shields, sleeves, or other suitable means to reduce the effects of temperature differentials in the shell or head. If necessary, the discharge end of a feedpipe must be fitted with a baffle to divert the flow from riveted joints. Feedwater may not be introduced through the blowoff.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-15. Blowoff valves and piping.

1. A "blowoff" means a pipe connection provided with valves through which the water in the boiler may be blown out under pressure, excepting drains such as are used on water columns, gauge glasses, or piping of feedwater regulators, etc., used for the purpose of determining the operating condition of such equipment. Piping connections used primarily for continuous operation, such as deconcentrators on continuous blowdown systems, are not classed as blowoffs but the pipe connections and all fittings up to and including the first shutoff valve must be equal at least to the pressure requirements for the lowest set pressure of any safety valve on the boiler drum and with the corresponding saturated-steam temperature.

2. A surface blowoff may not exceed two and one-half-inch [63.5-millimeter] pipe size, and the internal and external pipes, when used, must form a continuous passage, but with clearance between their ends and arranged so that the removal of either will not disturb the other.

3. Each boiler, except high temperature water boilers, must have a bottom blowoff pipe fitted with a valve or cock in direct connection with the lowest water space practicable.

4. All waterwalls and water screens which do not drain back into the boiler, and all integral economizers must be equipped with blowoff valves.

5. Except as permitted for miniature boilers, the minimum size of pipe and fittings is one inch [25.4 millimeters], and the maximum size is two and one-half inches [63.5 millimeters], except that for boilers with one hundred square feet [9.29 square meters] of heating surface or less, the minimum size of pipe and fittings is three-fourths inch [19.05 millimeters].

6. Condensate return connections of the same size or larger than the size herein specified may be used, and the blowoff may be connected to them. In such case the blowoff must be so located that the connection may be completely drained.

7. A bottom blowoff pipe when exposed to direct furnace heat must be protected by firebrick or other heat-resisting material which is so arranged that the pipe may be inspected.

8. An opening in the boiler setting for a blowoff pipe must be arranged to provide free expansion and contraction.

9. On a boiler having multiple blowoff pipes, a single master valve may be placed on the common blowoff pipe from the boiler, in which case only one valve on each individual blowoff is required. In such a case either the master valve or the individual valves or cocks must be of the slow-opening type.

10. Two independent slow-opening valves, or a slow-opening valve and a quick-opening valve or cock, may be combined in one body and may be used provided the combined fitting is the equivalent of two independent slow-opening valves, or a slow-opening valve and a quick-opening valve or cock and provided further that the failure of one to operate cannot affect the operation of the other.

11. The bottom blowoff pipes of every traction or portable boiler must have at least one slow-opening or quick-opening blowoff valve or cock conforming to the requirements of section 45-12-05-15.

12. Only one blowoff valve, which must be of a slow-opening type, is required on forced circulation and electric boilers having a normal water content not exceeding one hundred gallons [378.54 liters].

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-16. Factors of safety. The minimum factor of safety may not be less than four for existing installations. The commissioner authorizes an inspector to increase the factor of safety if the condition of the boiler or pressure vessel warrants it. If the owner or user does not concur with the inspector's decision, the owner or user may appeal to the commissioner who may request a joint inspection by the chief boiler inspector and the deputy inspector or special inspector. Each inspector shall render the inspector's report to the commissioner, and the commissioner shall render the final decision, based upon the data contained in all the inspector's reports.

History: Effective June 1, 1994; amended effective January 1, 2008.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-17. Inspection of inaccessible parts. If in the opinion of the inspector, as the result of conditions disclosed at the time of inspection, it is advisable to remove the interior or exterior lining, covering, or brickwork to expose certain parts of the vessel not normally visible, the owner or user shall remove such material to permit proper inspection and the drilling of any part of the vessel to ascertain thickness.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-18. Repairs and renewals of fittings and appliances. Whenever repairs are made to fittings and appliances or it becomes necessary to replace them, the work must comply with the requirements for new installations.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-19. Fusible plugs.

1. Fire-actuated fusible plugs, if used, must conform to the requirements of the American society of mechanical engineers code for power boilers.

2. They may be replaced by steel plugs if the boiler is gas-fired or oil-fired and is equipped with a low water fuel cutoff.

History: Effective June 1, 1994; amended effective January 1, 2006.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-20. Water columns, gauge glasses, and gauge cocks.

1. Outlet connections (except for damper regulator, feedwater regulator, low water fuel cutoff, drains, steam gauges, or such apparatus that does not permit the escape of an appreciable amount of steam or water therefrom) may not be placed on the piping that connects the water column to the boiler. The water column must be placed on the piping that connects the water column to the boiler. The water column must be provided with a valved drain of at least three-fourths-inch [19.05-millimeter] pipe size, the drain to be piped to a safe location.

2. Each boiler must have three or more gauge cocks located within the visible length of the water glass, except when the boiler has two water glasses located on the same horizontal lines. Boilers not over thirty-six inches [.914 meters] in diameter, in which the heating surface does not exceed one hundred square feet [9.29 square meters] need have but two gauge cocks.

3. For all installations where the water gauge glass or glasses are more than thirty feet [9.14 meters] from the boiler operating floor, it is recommended that water level indicating or recording gauges be installed at eye height from the operating floor.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-21. Steam pressure gauge.

1. Each steam boiler must have a steam gauge, with dial range not less than one and one-half times the pressure at which the safety valve is set, connected to the steam space or to the steam connection to the water column. The steam gauge must be connected to a siphon or equivalent device of sufficient capacity to keep the gauge tube filled with water and so arranged that the gauge cannot be shut off from the boiler except by a cock placed near the gauge and provided with a tee or lever handle arranged to be parallel to the pipe in which it is located when the cock is open.

2. When a steam pressure gauge connection longer than eight feet [2.44 meters] becomes necessary, a shutoff valve may be used near the boiler provided the valve is of the outside-screw-and-yoke type and is locked

open. The line must be ample size with provision for free blowing. Each boiler must be provided with a one-fourth-inch [6.35-millimeter] nipple and globe valve connected to the steam space for the exclusive purpose of attaching a test gauge when the boiler is in service so that the accuracy of the boiler steam gauge may be ascertained.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-22. Pressure on nonstandard traction engines. All steam traction engines that are of nonstandard boiler construction are limited to a maximum allowable working pressure of one hundred pounds per square inch [690 kilopascals], unless a thorough ultrasonic thickness survey, engineering analysis, and other inspections, approved by the chief boiler inspector, determine that a different pressure is appropriate. The maximum allowable working pressure may not be greater than that permitted by the original manufacturer. Boilers herein described are not subject to the age limits of section 45-12-05-03.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14

45-12-05-23. Duties of owners.

1. It is the duty of the owner or user of any steam traction engine on wheels to notify the chief boiler inspector of sale or other disposition of steam traction engines.

2. Within ten days of purchase, any person purchasing any steam traction engine shall notify the chief boiler inspector where it will be located and operated.

History: Effective June 1, 1994.
General Authority: NDCC 26.1-22.1-14
Law Implemented: NDCC 26.1-22.1-14